

REMARKS

Claims 1 through 24 are present in this application. Claims 16-23 have been withdrawn. Claim 24 has been added. Of the examined claims, claims 1, 3, and 4 are independent.

Restriction Requirement

The Office Action presented a requirement for restriction between one of three groups of claims. Applicants had elected the group consisting of claims 1-15 WITH traverse. Applicants submit that if linking claims 1, 3, and 4 are found allowable, the claims 16-23 should be examined for patentability.

Claim Rejection – 35 U.S.C. § 102(b); Okamura

Claims 3 and 7 (argued in the body of the rejection) have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 6,061,103 (Okamura). Applicants traverse this rejection.

Summary of Claim 3

In optical shifter liquid crystal cells, the liquid crystal cells change polarization direction when voltage is applied. The response speed to turn on a liquid crystal cell and the response speed to turn off a liquid crystal cell are different from each other. Consequently, in the case where one liquid crystal cell is switched from OFF to ON and another liquid crystal cell is switched from ON to OFF at the same time, the transitional state is adversely affected due to the

difference of the response speeds. This leads to an unwanted positional shift of the optical axis and to degradation of resolution and image quality.

Thus, optical shifters of claim 3 prevent a transitional state from occurring even if one optical shift section is switched from OFF to ON and the other optical shift section is switched from ON to OFF at the same time.

In particular, claim 3 is directed to embodiments of the present invention pertaining to an optical shifter (see for example, optical shifter 10 in Figure 18). The optical shifter comprises a first optical shifting section (e.g., 10'a) and a second optical shifting section (e.g., 10'b), the first and second optical shifting sections being arranged such that a light ray that has been transmitted through the first optical shifting section enters the second optical shifting section. Each of the first and second optical shifting sections comprising a liquid crystal element (e.g., g1 in Figure 16), including a first liquid crystal cell (e.g., 75a in Figure 16) and a second liquid crystal cell (e.g., 75b in Figure 16), and a birefringent element (e.g., g2).

In a preferred embodiment, the quartz plate **g2** of the first optical shifting section **10'a** is as thick as that of the second optical shifting section **10'b**. It is preferred that the magnitude of shift caused by the first optical shifting section **10'a** between the optical axes of the incoming and outgoing light rays thereof be equal to that of shift caused by the second optical shifting section **10'b** between the optical axes of the incoming and outgoing light rays thereof. (paragraph 0145).

Okamura

Okamura is directed to an image display apparatus for use in a head-mounted display

(Abstract). An embodiment shown in Figure 30 enables images having different R, G, B with time to be observed on the same pixel position, so that the resolution of the image can be increased by three times (column 21, lines 15-20). The arrangement shown in Figure 30 includes a liquid crystal display 71, first and second polarization converting liquid crystal plates 73 and 75, and first and second birefringent plates 74, 76.

Differences over Okamura

Claim 3 is directed to an optical shifter comprising a “first optical shifting section” and a “second optical shifting section”, each of the first and second optical shifting sections comprising a liquid crystal element including a “first liquid crystal cell” and a “second liquid crystal cell.”

The Office Action relies on Figure 30 of Okamura for teaching all elements of claim 3. However, Okamura does not teach two liquid crystal cells in each liquid crystal element (i.e., a liquid crystal element, in each of the first and second optical shifting section, including a first liquid crystal cell and a second liquid crystal cell). In other words, Figure 30 of Okamura does not show a liquid crystal plate 73, or 75, having two liquid crystal cells.

Thus, Applicants submit that Figure 30 of Okamura does not anticipate the structure recited in claim 3, as well as dependent claim 7. Accordingly, Applicants request that the rejection be reconsidered and withdrawn.

Claim Rejection – 35 U.S.C. § 103(a); Okamura

Claims 1, 2, 4-6, and 8-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Okamura. Applicants traverse this rejection.

Summary of Claim 1

Similar to the case discussed in the above for claim 3, optical shifters of claim 4 prevent operation such that one liquid crystal cell is switched from OFF to ON and the other liquid crystal cell is switched from ON to OFF, or minimize frequency of such operation. For example, as shown in Figure 11 voltages applied to liquid crystal elements of first and second optical shifting sections are simultaneously raised from the low level to the high level when the display subframe is shifted from a Position C to a Position A. These two drive voltages never change simultaneously any other time over a period (paragraph 0125; see also Figures 12, 14, and 15).

In particular, claim 1 is directed to embodiments of the present invention pertaining to an optical shifter (see for example, optical shifter 10 in Figure 10). The optical shifter comprises a first optical shifting section (e.g., 10'a) and a second optical shifting section (e.g., 10'b), the first and second optical shifting sections being arranged such that a light ray that has been transmitted through the first optical shifting section enters the second optical shifting section. Each of the first and second optical shifting sections comprising a liquid crystal element (e.g., g1) including a liquid crystal cell (e.g., g1 in Figures 7 and 8) and a birefringent element (e.g., g2).

In a preferred embodiment, the quartz plate g2 of the first optical shifting section 10'a is twice as thick as that of the second optical shifting section 10'b. It is preferred that the magnitude

of shift caused by the first optical shifting section 10'a between the optical axes of the incoming and outgoing light rays thereof be twice greater than that of shift caused by the second optical shifting section 10'b between the optical axes of the incoming and outgoing light rays thereof. (paragraph 0119).

Claim 4 is directed to embodiments of the present invention pertaining to an optical shifter, shown for example, in Figures 20 and 22.

Differences over Okamura

With respect to claims 1 and 4, the Office Action relies on a statement in Okamura that the amount of thickness determines the relative amount of shifting between two sections (relying on col. 6, lines 27-31). The Office Action also states that, "applicant only uses the thickness to determine the relative amount of shifting between the two sections." The Office Action concludes by stating that since both the present invention and Okamura modify magnitude of shift by variation in thickness, it would have been obvious to modify the width to achieve any ratio between the shifts. Applicants disagree.

Okamura does not disclose any specific shift amount or the ratio of shift amount caused by two optical sections. Shift amounts for two optical sections can be any of a variety of shift ratios (e.g., 1:10, 3:1, 2:0.5, etc.). Thus, though Okamura discloses a basic principle that shifting amount of the optical axis is determined by the thickness of the birefringent plate (col. 6, lines 28-31), Okamura fails to teach or suggest that the shift produced by the first optical shifting

section is “twice greater” than the shift produced by the second optical shifting section, as required in the claims.

Unlike Okamura, the present invention provides a solution to errors in position shift and degradation of resolution and image quality due to differences in response speeds. Optical shifters of claims 1 and 4 minimize the occurrence of one liquid crystal cell switched from OFF to ON and the other liquid crystal cell switched from ON to OFF, based on the specific ratio of shift magnitude, as recited in the respective claims (for example, as discussed above with respect to Fig. 11).

Accordingly, Applicants request that the rejection be reconsidered and withdrawn.

Claim Rejection – 35 U.S.C. § 103(a); Okamura, Ferguson, Tarumi

Claims 11-15 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Okamura in view of U.S. Patent 5,715,029 (Ferguson) and U.S. Application 2002/0047105 (Tarumi).

The Office Action relies on Ferguson for teaching a TN mode liquid crystal cell and Tarumi for teaching a birefringent element as a quartz plate of uniaxial crystals. However, Ferguson and Tarumi fail to make up for the above-stated deficiencies in Okamura. Thus, at least for the reasons in the above for claims 1, 3, and 4, Applicants submit that the rejection fails to establish *prima facie* obviousness for claims 11-15, as well.

Accordingly, Applicants request that the rejection be reconsidered and withdrawn.

New Claim

Claim 24 has been added and recites further features of the liquid crystal cells of the optical shifter of claim 3. For at least the reasons above for claim 3, Applicants submit that claim 24 is patentable as well.

Conclusion

In view of the above amendment, Applicants believe the pending application is in condition for allowance.

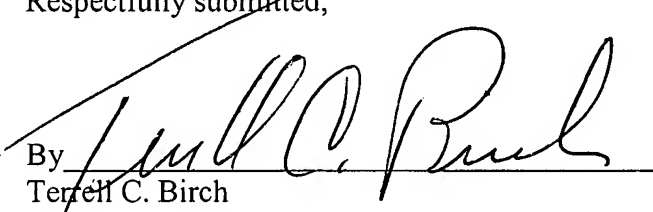
Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert W. Downs (Reg. No. 48,222) at the telephone number of (703) 205-8000, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

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Respectfully submitted,

RWB


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